Improving COLLEGE AND UNIVERSITY *Teaching*

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A CENTURY OF COLLEGE TEACHING
W. H. COWLEY
Stanford University

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"THESE BOOKS WERE STIMULATING"

VOLUME I NOVEMBER 1953 NUMBER 3

Improving College and University Teaching

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Art of Teaching

A noted artist from Japan recently gave a course in flower arrangement in Honolulu. After demonstrating and describing principles of artistic arrangement, the instructor permitted the students to try their own hands using foliage and flowers they had brought to class for the purpose. As the students devised arrangements, the instructor walked among the tables commenting on and criticising student efforts.

One student feared what he might say when he came to her table. She knew her fumbling efforts had resulted in a forlorn, formless little jumble. Nearby students knew also she had done a poor job. They watched the instructor to see whether he could find anything to praise in the tumbled sticks and twigs she had put together.

Many eyes watched the artist as he paused at her table. He looked at the confused pile for a moment without comment. Then with swift, deft movements he tore out parts of the arrangement, put new ones in. In a few moments he had achieved an arrangement which all recognized as an acceptable one.

The instructor stepped back and surveyed his work, then turned to the student. Surrounding students watched for the ax to fall, but instead of scolding the instructor flashed a complimentary smile at the shrinking student. His only comment was, "Very good."

Tension dropped and the grateful student returned the smile.—J.K.M.

Contributors

W. H. COWLEY will supplement "A Century of College Teaching"—published in this issue—with a second article in a later issue. Dr. Cowley knows college and university teaching from many points of view. As an undergraduate at Dartmouth, he helped formulate a notable student report on the liberal arts curriculum. He has served on the administrative staff of the University of Chicago, as research associate and assistant professor of psychology at Ohio State University, as president of Hamilton College, and as professor of higher education at Stanford University (since 1945).

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Quarterly

This issue completes the first slender "volume" of this new journal. For those who wish to bind their copies a volume title page and index are included.

Subscriptions now reach 53 states and territories. As this issue goes to press a southeastern university sends an order for 12 two-year subscriptions. Contributions already on hand would more than fill the next issue. Authors in the first four issues are college and university teachers from the Atlantic Coast, the South, the Mid-west, and the Pacific West. The broad acceptance of the publication has encouraged the editorial board to expand to four issues a year. Beginning with the February 1954 issue the journal will be published quarterly.

Editorial Committee Addition

New member of the Editorial Committee is Dr. James Kenneth Munford, who has returned to Oregon State College after two years service as a lieutenant colonel in the Air Force. He is associate professor of English and associate editor of publications. In the graduate school he offers a course in the American College and University. Dr. Edwin D. Duryea, Jr., has moved to a new position as director of adult education and coordinator of research at the University of Akron but will continue as an editorial adviser to the journal.

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A CENTURY OF COLLEGE TEACHING

By

W. H. COWLEY

Stanford University

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MANHATTAN

When shall we recognize the truth of our situation? Only when we see ourselves and the events of our day as one act in a drama which began long before we were born and will not be played out until long after we are dead. We shall never manage the present, or make any sense of it, unless we have explained our past well enough to imagine our future.
Walter Lippmann.[13]

This article compares the college teaching of a century ago with that of today on ten variables: the teacher, the student, that which is taught, the teaching process, the learning process, curricular structuring, the logistics of teaching, the social context, examination methods, and appraising teaching performance.

First a brief general description of American higher education in 1853. What today goes by the name of the independent liberal arts college held dominion. Just how many existed in 1853, no one knows exactly. Well over 500 had been established throughout the nation before the Civil War, but only one in five continued into the 20th century. All were small, Yale, the largest, enrolling 443 undergraduates and 151 professional students in law, medicine, science, and theology. The great majority of the latter had not had any college work; many were semi-literate.

A number of technical schools had been established, but they had little status. The dozen or so state universities in operation struggled to keep alive on meager budgets and with little public interest. They differed hardly at all, moreover, from the reigning "academical" or "literary" colleges. The University of Virginia had opened in 1825 with ambitious plans, but the economic conditions of the South and administrative inadequacies had not permitted it even to approach the fulfillment of Jefferson's hopes. The University of Michigan, although founded in 1819 and opened in 1841, did not really get under way until it elected Henry P. Tappan its first president in 1852. He had an impressive program, but he stirred up so many antagonisms that Michigan did not begin its half century of leadership of the state universities until James Burrill Angell became president in 1871. In short, in 1853 universities had not yet appeared upon the American scene.

Nor had professional schools as we know them today. Pennsylvania, Columbia, Harvard, and Dartmouth had established medical schools in the late 18th century, and others followed in the first half of the 19th; but though they bore the names of the colleges to which they were attached, they operated independently as did also the college-connected schools of law and divinity. Most of the professional schools had no college affiliations, and the majority of their promoters operated them for financial profit. Further, all but a few of those who attended either of these two types of professional schools entered without ever having been to college; and an appreciable percentage of them had the barest rudiments of formal education. When in 1870, for example, President Charles W. Eliot of Harvard proposed that written examinations be substituted for oral examinations at the Harvard Medical School, the dean responded: "Written examinations are impossible in the Medical School. A majority of the students cannot write well enough."[7]

The seeds of higher educational change planted by Franklin and Jefferson and tended by President Francis Wayland of Brown, Jonathan B. Turner of Illinois, Henry P. Tappan, and a few others were taking root and thrusting up tentative sprouts in 1853, but the stalk did not appear until 1862 when President Lincoln signed the Land-Grant College Act. That event above all others led to the foliation of American higher education as we know it today. Some historians cite the date of 1876 as more crucial since in that year Johns Hopkins University opened, emphasizing graduate instruction and research; but President Daniel Coit Gilman of Hopkins thought out his program during his years as the executive head of two land-grant institutions—the Sheffield Scientific School at Yale and the University of California.

No extraordinary changes occurred in 1853, and yet it must be reckoned a fateful year for the reason that four of the supreme educational leaders of the post-1862 era then began their careers. Charles W. Eliot took his bachelor's degree at Harvard and Andrew Dickson White his at Yale; James Burrill Angell, Brown 1849, became a master of arts of the same institution; and Gilman, Yale 1852, completed his post-graduate year at Harvard. White became president of Cornell in 1868 and set the pattern for the land-grant institutions; Eliot began his mighty career

at Harvard in 1869 and demonstrated how a small literary college with its face toward the past could be converted into a large forward-looking university; Angell took command of the Michigan wrangle-tangle in 1871 and made it the exemplar of "the state university idea"; Gilman, the most fertile thinker of the group, became president of the University of California in 1872 and then of the soon-to-be-opened Johns Hopkins University in 1874.

At the end of the Civil War the nation quivered in a power saltation of fabulous proportions, and everything changed in American life including higher education. These four men and their associates designed and directed the programs that the new era demanded. The trends they set in motion continue energetically into the present, and hence the student of higher education profits from reviewing what they had experienced as undergraduates and what changes they wrought.

The Teacher

Specialized teaching had been established, but not until well after 1853 did it start to approach present proportions. When in 1872, for example, David Starr Jordan began his career as professor of natural history at Lombard College in Galesburg, Illinois, he found that

> My "chair" demanded classes in Zoology, Botany, Geology, Mineralogy, Chemistry, Physics, Political Economy, Paley's "Evidences of Christianity," and, incidentally, German and Spanish! I also had charge of the weekly "literary exercises," consisting of orations and the reading of essays. . . with a class in Sunday School as a good measure.[12]

The ranks of adjunct and assistant professor had begun to appear a century ago; but the two-staff system of professors and tutors, copied in the 18th century from Oxford and Cambridge, continued to be dominant. The former had permanent tenure; the latter were usually young men "reading" under the direction of one of the professors before going into the ministry or to Europe for advanced instruction. The professors lectured part of the time; but, like the tutors all of the time, they also heard "recitations." Andrew Dickson White has described as follows the teaching at Yale:

> The worst feature of the junior year was the fact that through two terms, during five hours each week, "recitations" were heard by a tutor in "Olmstead's Natural Philosophy." The text-book was simply repeated by rote. Not one student in fifty took the least interest in it; and the man who could give the words of the text most glibly secured the best marks. . . Almost as bad was the historical instruction given by Professor James Hadley. It consisted simply in hearing the student repeat from memory the dates from "Putz's Ancient History." How a man so gifted as Hadley could have allowed any part of his work to be so worthless, it is hard to understand. . .
>
> In the senior year the influence of President Woolsey and Professor Porter was strong for good. . . Yet it amazes me to remember that during a considerable portion of our senior year no less a man than Woolsey gave instruction in history by hearing men recite the words of a textbook. . .[21.1]

Research as understood today hardly existed; but, in the English conceptual tradition, most professors produced scholarly articles and books, the necessity of factual research not yet being widely recognized. They followed the personal ideal of broad cultivation of mind and spirit, but apparently few of them were able to communicate their interests and enthusiasms to their students. Their teaching methods prevented as did also student attitudes of distrust and antagonism. Professor Andrew P. Peabody of Harvard has described faculty-student relationships before the modern era:

> The students certainly considered the Faculty as their natural enemies. There existed between the two parties very little of kindly intercourse, and that little generally secret. If a student went unsummoned to a teacher's room, it was almost always by night. It was regarded as a high crime by his class for a student to enter a recitation-room before the ringing of the bell, or to remain to ask a question of the instructor. . . The professors, as well as the parietal officers, performed police duty as occasion seemed to demand; and in case of a general disturbance, which was not infrequent, the entire Faculty were on the chase for offenders,—a chase seldom successful. . .[16.1]

The Student

Students have changed during the past century even more than professors. So many diverse types of higher educational institutions have come into existence that one cannot safely generalize about the many varieties of students they enroll. Contrary to the prevailing opinion, however, the undergraduates of 1853 averaged a bit older than present-day students, veterans excluded. In the 17th century freshmen entered about 17, in the 18th nearer 16, but in the 19th the average age increased steadily until about 1890 it passed nineteen and a half.[24] Consider, for example, the Yale Class of 1849 to which belonged Timothy Dwight, later to be president of Yale. He entered at 16, but the oldest member was 29. At graduation the class averaged 22 years and three months.[6]

Although the undergraduate of a century ago had about the same physiological maturity as his counterpart of today, he seems not to have been

as serious minded either about his studies or about the state of the world. The big change from irresponsible light-heartedness has occurred during the past quarter of a century, but between 1853 and the beginning of the depression in 1929 athletics and coeducation changed the nature of the undergraduate's indifference to his studies. The first intercollegiate athletic contest had occurred in 1852: a boat race between Harvard and Yale on Lake Winnipesaukee. Then came baseball, football, basketball, and a dozen other sports to absorb student energies and to send into limbo the riots and rebellions that had been common occurrences since the Middle Ages.

Outbreaks of large proportions took place at Harvard, for example, in 1766, 1768, 1790, 1805, 1807, 1818, 1823, 1834, 1841. Some of them related to food such as the Great Butter Rebellion of 1766 which "took more than a month to quell,"[19] the "Bread and Butter Rebellion" of 1805, and "The Rotten Cabbage Rebellion" of 1807. Others, however, resulted from dissatisfaction with the prevailing methods of teaching and discipline, and The Great Rebellion of 1823 led to the crucial Harvard reforms of 1825. Morison reports the Great Rebellion as follows:

> The class of 1823 was uncommonly rowdy. A class history kept by a member chronicles class meetings and forbidden dinners, battles in commons, bonfires and explosions in the Yard, cannon balls dropped from upper windows, choruses of 'scraping' that drowned Tutors' voices in classroom and chapel, and plots that resulted in drenching their persons with buckets of ink-and-water. A schism developed between the 'high-fellows' of the class and the obedient 'blacks,'. . . The climax came in the spring of senior year when a 'black' played informer against a 'high fellow' who was expelled; and the rebels swore on oath under the Rebellion Tree that they would leave College until the departed hero was reinstated and the informer deprived of his Commencement part. The Faculty, determined to rule, expelled forty-three students out of a class of seventy, almost on commencement eve; and although John Quincy Adams, the parent of a rebel, protested vigorously, President and Fellows were inflexible.[15.1]

The occasional spring bacchanals of today seem rough and irresponsible only to those who do not know what college students used to be like before athletics drained off their animal spirits, before coeds tamed them, before the problems of economic stability and military preparedness made them more serious than Anglo-Saxon youths have ever been in history, and before vastly improved teaching aroused the interests and directed the activities of increasing numbers of undergraduates.

That Which is Taught

This caption might read "The Content of the Curriculum," but the Old American Literary College did not limit instruction to the curriculum, nor did it confine its attention to the teaching of knowledge and skills. It had perhaps more interest in teaching the attitudes of "the Christian scholar and gentleman." Few undergraduates behaved as such, but the faculty did its best to indoctrinate them by requiring their attendance at sixteen chapel exercises a week—daily at 5 a.m. in the spring and fall (6 a.m. in the winter), 5 p.m. in the afternoon, and four times on Sunday. Faculty members were also expected to attend. When Cornell opened in 1868 without compulsory attendance at chapel, the clergy denounced President White so roundly and persistently that he defended himself on this and related counts by counter-attacking with his redoubtable two-volume work, *The History of the Warfare of Science with Theology.*

Today, except in some of the institutions controlled by churches, American colleges and universities do not formally attempt to educate student attitudes. Nor do they give as much direct attention as did the Old American Literary College to training in the skills of writing and speaking. Chiefly they gave their students what William James has called knowledge-of-acquaintance but which might now graphically be called know-about as distinguished from know-how.

Everyone is informed of how extensively knowledge has expanded since the founding of the nation and how curriculums have had to be periodically reconstructed. To break the monopoly of the classical languages and to admit the sciences, the modern languages including English Literature, the social sciences, and latterly the fine arts and music, educational reformers campaigned after the Civil War under the banner of "The New Education" and employed the mechanism of the elective principle. Observe the word *principle.* Most writers refer to "the elective system," but the principle expressed itself in at least a dozen systems. The "free elective system" of Harvard has by all odds had the most publicity, but Harvard abandoned it in 1910. No other institution followed it extensively except Harvard College, not even Harvard's Lawrence Scientific School which until just before World War I also admitted undergraduates.

The elective principle has been under attack since its initiation by Jefferson at the University of Virginia, but few things about American higher

education seem more certain than that in one form or another it will continue to operate permanently. It would require a long article to defend this statement, and so enough to observe that devices such as integration courses, majoring, and honors programs counterbalance rather than countermand the elective principle.

Perhaps the chief change in course offerings over the past century has been the admission of occupational-training subjects. These first appeared in "parallel courses" offered for special groups of students of the "academical colleges," but they got their real start in the land-grant institutions. From there they moved into the universities and even into many liberal arts colleges. Contrary to the common belief that the Old American Literary Colleges directly trained clergyman and were hence vocational colleges, they had no such conception of themselves. They thought their function to be the training of what Woodrow Wilson later called "the managing minds" of the nation, and they gave all their students the literary education that they ardently believed appropriate for such leaders.[23] The situation has changed so much during this present century in particular that one can find instruction in almost any subject including not a few that evoke the derision alike of foreigners and of not a few Americans.

Much of the criticism of American higher education focuses here, but many of the critics seem not to understand how egalitarianism has led to structural diversity in the United States and hence to the admission of vast numbers of students who could not be admitted to the universities of other countries. Many acquire the bachelor's degree whom only a surrealist could call educated men and women, but the best institutions produce increasing numbers of graduates who are at least the equals of the products of the universities of other nations. Statistical evidence in support of this generalization seems never to have been gathered, but a few thousand dollars worth of research effort could organize it readily.

In any event, American colleges and universities teach a range of subject matter which would stagger the credulity of the faculty members of a century ago. If some of it would seem to them to be too inconsequential to be called *higher* education, much of it would pass if not surpass their standards of significance and rigor.

The Teaching Process

As observed, most of those who taught in the Old American Literary College acted chiefly as drillmasters and disciplinarians. On the latter count many of them did poorly. Andrew Dickson White has described the troublous existence of the professors of the small New York college which he attended in his freshman year:

> It was my privilege to behold a professor, an excellent clergyman, seeking to quell hideous riot in a student's room, buried under a heap of carpets, mattresses, counterpanes, and blankets; to see another clerical professor forced to retire through the panel of a door under a shower of lexicons, boots, and brushes, and to see the president himself, on one occasion, obliged to leave his lecture-room by a ladder from a window, and, on another, kept at bay by a shower of beer-bottles.[21.2]

Both teaching and discipline improved when new methods of instruction became available. First came the lecture method which flourished first at Harvard, Peabody writing that even in the 1820's "it may be doubted whether so many lecturers of an exceptionally high order have ever, at any one time, been brought together in the service of an American college."[16.2] Conservative Yale and its numerous satellites, however, approved of the lecture method slowly. As late as the 1870's President Noah Porter opposed it entirely for underclassmen and wrote that "for the more advanced students of a college, and even for students of professional schools, instruction by lecturing should be sparingly applied."[18]

The frequent debates about the validity of the lecture method waned when the newer subjects imported methods from Germany and invented new ones of their own. Thus chemistry employed the laboratory method which Liebig had developed at Giessen, and the laboratory idea moved into all the sciences. Meanwhile the burgeoning social sciences and the literary subjects adopted the seminar, the first established apparently having been that of Charles Kendall Adams in history at the University of Michigan in 1871. The case method in law emerged at the Harvard Law School in 1870 and spread later to schools of business administration. Geology developed the field trip, engineering the summer camp, biology the experiment station.

Through all these new methods college and university teachers sought to stimulate give and take with their students, that is, the discussion method. By 1886 instruction had improved so markedly that James Freeman Clarke could observe at the Harvard commencement dinner of

that year: "Formerly, the only business of a teacher was to hear recitations, and make marks for merit. Now, he has the opportunity of teaching. This is one of the greatest discoveries of modern times,—that the business of a teacher is to teach."[15.2]

The technique of teaching involves manner, matter, and method; and the least of these seems not to be method. "What I tried to teach," Henry Seidel Canby has observed about his teaching of English at Yale, "was never so important as how I taught it."[5.1] And yet a constant debate goes on between those who deplore "the vicious half truth that if you know your subject you can teach it"[3] and those who with equal vehemence decry "the heresy that technique makes a successful teacher."[10] Fortunately this fruitless controversy seems to be abating.

The Learning Process

The college teachers of a century ago had a clear, strongly held conception of how people learn. It rested on the Faculty Psychology of John Locke, set up "the disciplined mind" as the prime if not sole purpose of education, and hence organized the learning process to promote discipline. In 1828 President Jeremiah Day, a mathematician, and Professor James L. Kingsley, a classicist, defended their subjects in a statement of Faculty Psychology which many opponents of the New Education cited as gospel well into the 20th century:

> A commanding object, therefore, in a collegiate course, should be to call into daily and vigorous exercise the *faculties* of the student. Those branches of study should be prescribed, and those modes of instruction adopted, which are best calculated to teach the art of fixing the *attention,* directing the train of *thought,* analyzing a subject proposed for investigation; following, with accurate *discrimination,* the course of argument; balancing nicely the evidence presented to the *judgment;* awakening, elevating, and controlling the *imagination;* arranging, with skill, the treasures which *memory* gathers; rousing and guiding the powers of genius.[2] (Italics added.)

Among present-day psychologists and philosophers, except possibly some of the Scholastics, Faculty Psychology has no adherents. It has been all but destroyed by innumerable investigations and by such statements as the following by Alfred North Whitehead:

> . . .whatever its weight of authority, whatever the high approval which it can quote, I have no hesitation in denouncing it as one of the most fatal, erroneous, and dangerous conceptions ever introduced into the theory of education. The mind is never passive; it is a perpetual activity, delicate, receptive, responsive to stimulus. You cannot postpone its life until you have sharpened it. Whatever interest attaches to your subject matter must evoke here and now; whatever powers you are strengthening in the pupil, must be exercised here and now; whatever possibilities of mental life your teaching should impart, must be exhibited here and now. That is the golden rule of education, and a very difficult rule to follow.[22]

Whitehead's "golden rule of education" has indeed been "a very difficult rule to follow," so difficult in fact that no widely accepted conception of the learning process has replaced the disciplinary ideal of Faculty Psychology. The studies of educational psychologists have produced significant facts and generalizations, but no adequate arrangements have yet developed for bringing them to the attention of college teachers or of prospective college teachers. The defects badly need remedying.

Curricular Structuring

The Old American Literary College had no problems of structuring subject matter. It operated with a prescribed curriculum, every student taking every course offered. When various forms of the elective principle began to make inroads into this entrenched system, problems of structuring course offerings popped up everywhere. The simplicity of the past has given way to the multiplicity of the present—to the organization of subject-matter into departments and divisions, to the partitioning of the four-year course into upper and lower divisions, to concentration or majoring, to course prerequisites, to sectioning on the basis of ability, to honors programs, and to a score of other organizational arrangements.

Obviously these cannot be discussed here. Enough to observe that structural considerations have continuous and definitive effect upon instruction. He who teaches, for example, a lower division required course in chemistry needs considerably different teaching skills from those needed by the person who teaches an upper division course in history surrounded by prerequisites and open only to top-flight students. In a simple, unitary curricular situation perhaps one can talk about the art of teaching; but the modern college or university requires many *arts* of teaching and many different kinds of teaching artists.

The Logistics of Teaching

The old-type college teacher required only a room with enough benches to seat the members of his class. It did not include a blackboard, an invention said to have been imported from Ger-

many a century and a quarter ago. Since the teacher stood aloof from his students, he had no office, a situation still in effect in at least one Eastern liberal arts college as late as 1939.

Need the extent and significance of the change be labored? Mark Hopkins' tediously cited but fictive log has been split up logarithmically. The resulting logistics of teaching have become a complicated and essential business. Consider only the change in college libraries. In 1876 Harvard had 227,650 volumes in its several collections; 75 years later the number totalled almost six million.[4.1] Today Muskingum College owns about 40,000; but six years after William Rainey Harper took his bachelor's degree there in 1870, it possessed only 900.[4.2]

Meanwhile attitudes toward libraries have changed strikingly. In 1858 the trustees of Columbia College voted to increase library hours from nine to ten a *week*, and about the same time librarians began to be concerned with the circulation of their books rather than merely with protecting them. John Langdon Sibley, librarian of Harvard College from 1856 to 1877, however, gave up his custodial responsibility reluctantly. A friend of his, the story goes, met him on the street one day; and in response to the query as to why he looked so happy, he replied, "All the books are in excepting two. Agassiz has those, and I am going after them."[4.3]

The Social Context

Until relatively recently the college teacher had no conception of teaching as a social enterprise. Henry Seidel Canby, who graduated from Yale in 1899, has observed that his teachers there "talked to us as visitors at the Zoo might deal with a jaguar from the jungle, futility and ignorance on either side of the bars. . . They studied everything but us."[5.2] Certainly they did not study the social dynamics of the classroom and the campus. The resulting warfare has been described by another Yale graduate, William Lyon Phelps of the Class of 1887:

> Teachers were often chosen for their ability as policemen. Now the question of order and good behaviour is never even considered, because there is no occasion for it. Students are as well-behaved in the classroom as in church. In those days, it was so customary to throw coal through a tutor's window, that he used to say, 'My salary is a thousand dollars, and coal thrown in!'
>
> When I was an undergraduate, it was part of every instructor's duty, if he had a room on the campus, to maintain order. It was not an uncommon sight, in the midst of an uproar at night, to 'spot' a professor in his nightgown, hiding behind a tree, and taking down names of those unfortunate students whose faces were revealed by the bonfire. Then someone yelled 'Faculty!' and there was a scattering.[17]

Athletics and coeducation have played their large parts in ending the warfare between students and faculty and in all but killing off feuding among student groups. So also have improved teaching and a growing understanding of the sociology of student life. A. Lawrence Lowell saluted the new point of view of administrators and professors in the first sentence of his inaugural address as President of Harvard in 1909:

> Among his other wise sayings, Aristotle remarked that man is by nature a social animal; and it is in order to develop his powers as a social being that American colleges exist. The object of the undergraduate department is not to produce hermits. . . but men fitted to take their places in the community and live in contact with their fellow men.[14]

Until the depression and the war sobered undergraduates, clearly many of them overplayed the role of social animal. Some still do, but their numbers decrease noticeably. Meanwhile an awareness spreads among college teachers that social factors continuously act upon the teaching and learning processes. Some present-day critics of teaching assert that the degree of such awareness leaves much to be desired, but "patience is a flower that grows not in everyone's garden."

Examining Students

Until just a century ago all college examinations were oral. Written examinations seem to have been established in this country first at Yale in the year 1850-51 in the form of biennial sessions for each class at the end of the sophomore and senior years. Harvard followed some years later with written term examinations, and the plan spread slowly to other institutions. Dartmouth, for example, did not adopt written examinations until 1871,[20.1] and remnants of the oral method continued there until 1893.[20.2] Standards for passing remained low until almost this century, the passing grade at Dartmouth being raised from 40% to 50% in 1877[20.1]

The quality of oral examinations has best been described by Henry James reporting the experience of his father, the philosopher William James, upon being examined in 1867 for his doctor of medicine degree at the Harvard Medical School:

> In a large room a number of professors sufficient to examine in the nine principal subjects disposed themselves at suitable intervals. The students circulated singly from one to the next and were quizzed

on a new subject at each station of the journey. Every ten minutes a presiding functionary sounded a bell and the candidates moved along. When the bell had pealed nine times. . . . the examiners were expected to be ready to vote. This they did without consultation. . . Each had a piece of cardboard that was white on one side and marked with a black spot on the other. The Dean called the name of a candidate and pronounced a formal question and a command—"Are you ready to vote?—Vote!" The nine examiners simultaneously thrust forward their cards. If the Dean counted not more than four black spots, the candidate received his degree. . . . When the candidate had thus captured his degree, he could hang out his sign and work his ignorance at will on the patients who come to him, for under the laws as they then were a School diploma conferred the right to practice.[11]

These were the examination practices of but a little while ago. Meanwhile the statistician has appeared upon the scene with his coefficients, correlations, and standard deviations. To most professors he speaks a strange and harsh language, but nonetheless few would choose to return to the primitive practices he has helped to consign to oblivion.

Appraising Teaching Performance

For several decades now debates have broken out periodically in many institutions about the desirability of what usually goes by the name of "faculty rating." Generally they fizzle out. And yet college students have been appraising their professors with considerable effectiveness, albeit with uncertain accuracy, during all the three centuries of American higher educational history.

Students' disorders in class constituted a kind of appraisal, but even more pointed were the judgments passed and executed out of class. Dartmouth students, for example, "rated" an unpopular faculty member by means of "horning," that is, blowing tin horns below his windows, usually at night. Such a horning occurred as late as 1896:

. . . an instructor who had acquired some degree of unpopularity was selected as a victim of a demonstration of this type. When seated in his office in Thornton Hall in the evening, he was assailed by a mob made up for the most part of members of the sophomore class, many of them disguised, and bringing with them whatever noise-making instruments were available, who proceeded to make the night hideous with their clamor. The instructor, who was in plain sight of the mob, remained, to all appearances, quite undisturbed. Apparently angered by this exhibition of *sang-froid,* the rioters proceeded further in their disorderly conduct than was the usual custom. Snowballs began to fly through the windows, and soon a convenient pile of coal. . . furnished even more effective missiles.[20.3]

Boisterous methods of rating faculty members no longer rive the academic atmosphere, but the enterprise goes on by means hardly less shocking to some faculty members—student polls, formal rating scales, and the like. For 30 years, for example, the *Harvard Crimson,* owned and edited by students, has published every spring a brief but sometimes stinging evaluation of every faculty member who teaches undergraduate courses; and scores of student groups now regularly express their opinions of the teaching they encounter. Sometimes they use their own forms but more often those provided by faculty committees, administrative officers, and members of psychology departments. The 1933 A.A.U.P. Committee on College and University Teaching recorded its skepticism about the validity and wisdom of student ratings, but it went on to observe that the initiative in evaluating the quality of teaching should be taken by "college teachers themselves"[1.1] because

If success in research were left to impress itself upon the mind of the college community through the gossip of undergraduates and the chance remarks of alumni it would frequently fail to be appreciated. Teaching ought not to remain under this handicap of having no agreed upon means of fair evaluation. For so long as that situation continues it is inevitable that research and other non-teaching activities will be used, more extensively than they ought to be, as the measure of a teacher's value to his college.[1.2]

At some institutions this advice has been followed, notably at the University of Washington where, according to Edwin Ray Guthrie, former dean of the graduate school, "between one-fourth and one-third of the faculty each year" request student evaluations and where the undertaking keeps "fully occupied a staff of two full-time and three half-time researchers" under the direction of the dean of the graduate school. He reports an .89 coefficient of reliability of student estimates of teaching and heartily approves of their use.[8] His findings and those of other investigators have been influential in extending their employment. A May 1949 editorial in the *Harvard Crimson* may be indicative of a growing attitude of tolerance of them if not approbation:

This year the Chemistry Department departed from a University-wide tradition of indifference to section teaching by offering eleven prizes to the men who rate highest on a poll conducted among the members of six big undergraduate chemistry courses. The poll, devised by Professor Kistiakowsky, chairman of the department, questions students as to the personality and scientific ability of their section man as well as to the time they think he contributes to teaching. The prizes, each amounting to slightly

> under a hundred dollars, will come from a fund given by a Visiting Committee of the Board of Overseers. . . .
> Recognition of the student's evaluation of his teachers is a valuable and practical attitude for the Chemistry Department to assume. After all, it is the student himself who knows whether or not he is really learning; more than that, the results of the Chemistry Department's poll indicate that the student's views as to a man's teaching ability correspond remarkably well to the opinions of the senior members of the department as to his promise in chemistry. . . In establishing an active program for improving section men's teaching efforts, the department has set a precedent worthwhile of notice by the rest of the University.[9]

Some who read this article may be led to the conclusion that the changes made during the past century have been so monumental and meritorious that most of the recent discussion of improving college and university teaching can be dismissed as inconsequential hubble-bubble. That would not be a justifiable inference for the reason that the whole story has not here been told. For example, exactly in the middle of the past century—in 1903—the Harvard Faculty of Arts and Sciences received a pivotal report from its Committee on Improving College Instruction appointed the previous year. Its recommendations led to a drastic reorganization of Harvard undergraduate teaching and to conspicuous changes in many other institutions. Then during the dozen years between 1924 and 1936 a group of national educational associations cooperated in a massive audit of the problems of college and university teaching. To assess the significance and the prospects of the present demands for change, one must be informed about these campaigns of 1903 and 1924. What they attempted and what they accomplished will be reviewed in a later article.

August 28, 1953

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What Knowledge Is

"Shall I teach you what knowledge is? When you know a thing, to hold that you know it; and when you do not know a thing, to allow that you do not know it—that is knowledge."— The Analects of Confucius. In: The Chinese Classics Translated by James Legge, New York: John B. Alden, 1885.

HUMANISTIC–SOCIAL STUDIES RAISE THE STANDARDS OF ENGINEERING EDUCATION*

By

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If we listen to our students, and believe them, we must conclude that neither humanistic-social studies nor technical courses need raise the standards of engineering education. They are already too high. According to the rumor, for four years engineering colleges alienate their students' inalienable rights of life, liberty, and pursuit of happiness, to say nothing of depriving them of considerable amounts of private property by a "dues" process of tuition, textbook and equipment costs, and breakage fees. Engineering education, some of them tell us, is just a premajor to an insane asylum.

Humanistic-social studies should raise the standards of engineering education, then, not by making it tougher. After all, there are limits. If our curricula still permit sufficient time for some students to indulge in extracurricular activities, play a little bridge now and then, and occasionally (even outside of vacations) get eight full hours of sleep in a day, that is all to the good.

Thus, if the humanities and social studies raise the standards of engineering education, they will do so, not by elevating them, but by broadening them—providing a training more adequate to needs of students than is a purely technical one.

Were I speaking here fifteen years ago, I should now be trying to convince you that the humanities and social studies would be desirable additions to engineering curricula. But that battle has just about been won everywhere. We no longer argue, as we once did, whether the humanities and social studies are more important than engineering, whether engineering or the social sciences will save man. We have lived and worked together long enough to have acquired mutual respect and a desire to cooperate in a common project of giving a group of professional students the best education we can in a four-year period.

Let me state here one or two personal convictions which will clarify my basic position. First, I believe that engineering educators are to be congratulated both for their vision and for their hard work in developing nontechnical programs to accompany technical curricula. Second, I believe that engineering education is rapidly becoming one of the best types of higher education in the nation because, as it is developing now, it provides not only professional training but also education for citizenship and for personal growth.

Third, if I mention in this paper certain needs of engineering students, I certainly do not imply that they alone have these shortcomings, nor do I imply that their needs are necessarily greater in all respects. We all need happiness, well-rounded training, and well-developed personalities. But a brief glance around us shows people in all walks of life and with all kinds of training who are unhappy, angular, ill-developed, frustrated, and narrowly specialized. Engineering students do not stand alone in a need for "humanizing."

Briefly, then, my position is this: engineering education is providing leadership in the development of a higher education fitted to the needs of today's world; to this education humanistic-social studies offer an important contribution, even though there is no assurance that mere exposure to these studies will make the engineer of tomorrow a paragon of virtue, social vision, and individual greatness.

Humanistic-social studies can help, and they can do no more than help, raise the standards of engineering education by doing four things: (1) teach good thinking, (2) show the nature of man and of the cultures he creates, (3) illustrate the inevitable influence of the individual upon the problems of his society, and (4) provide opportunities for the student to appreciate and to realize some of his own creative potentialities in his work and outside of it.

TEACHING GOOD THINKING

Engineers are justly proud of "the engineering method;" the historian is also proud of "the historical method" and the sociologist of "the method of social science." All of these methods are, of course, methods of thinking. And in the final analysis all of the methods are basically alike: determination of purpose and goal, analysis of the

* A paper delivered at the sectional meeting of the American Society for Engineering Education, Pullman, Washington, April 24, 1953.

problem into its elements, gathering of material, use of basic principles, and putting material together to get the desired result.

Here the humanistic-social studies and technical courses should complement and reinforce each other in teaching good methods of thinking. In our own teaching of report writing at the University of Washington, for example, we are more and more emphasizing that the best approach to report writing is the method used in the solution of technical problems; only a small part of the job is actual writing. By far the most significant activity comes in the analysis of what the report is supposed to do, what information must be obtained, and how all of the information may be put together and the report designed to achieve the original purpose.

In many other areas good thinking can be taught. Discussion of contemporary problems certainly should be more than a debate in which two sides enjoy the catharsis of expressing their preconceptions and prejudices. It should be a search for a satisfactory answer to some problem; and it should be unmistakably clear that finding an answer is based upon a determination of what problem is to be solved, the standards which tell us whether it has been solved, the accumulation of adequate evidence to provide a solution, and using the evidence so that it will give the solution.

Most important of all, we must remember that adequate training in good thinking cannot be given through engineering problems alone. Students must use good methods habitually and in all situations. If they are to learn to do this they must practice in a wide variety of situations, not merely in the solving of technical problems.

Nature of Man and of His Culture

Good methods of thinking are not all-important. Students need also an understanding of themselves and of their relationship to the cultures which they help to build.

Certain aspects of engineering training and experience create special needs for engineering students. The very virtues of the engineering method—reliance on objectivity, gathering of hard facts, and application of impersonal principles—may create difficulties. The student may come to see the whole universe in terms of the Newtonian world-machine, as a great mechanical process running in exactly predictable ways, subject to purely mechanical manipulation, cold, rational, manageable. Life, both of himself and of other men, because it is a part of this universe, the student is likely to interpret in the same way. The emotional nature of man will be ignored and all persons will be expected to act rationally at all times. Give a man the facts and he should arrive at a certain conclusion and course of action just as a machine, once set up, will complete a process when the power is turned on.

Two great difficulties may arise out of this interpretation of man as a rational machine. The first is likely to develop in the engineer's relationships with other people. If he is working for someone else, he may expect his boss to be something more than human; he may figure that the mere suggestion of a reasonable solution to a problem will always be received by his employer with joy and thanksgiving. If so, what a disappointment he will get some day! Or he may look upon the problem of salaries and promotions as being entirely matters of judgment upon objective evidence, and consequently feel hurt, thwarted, and helpless when he discovers that his superior is looking upon the evidence in a different way. Perhaps he is supervising the activities of other men. Then the engineer will certainly be smothered in problems if he expects that he can treat his subordinates, whether laborers or other engineers, as mechanical brains into whom it is necessary only to feed certain information in order to get the desired result.

Not all engineers must or do have these attitudes, but the very nature of the engineering student's work is likely to produce them if they are not counteracted by some means. And countered they must be. That engineer who is unable to see man as man rather than as a machine, as man subject to emotions, prejudices, traditions, ideals, and differing points of view arising out of diverse experiences—that engineer can never make most effective use of his own ability at home, in his profession, or in the community.

The second great difficulty which may arise out of an interpretation of man as a rational machine is in the area of the man's relationship to himself. He who regards man as a mechanical marvel will not only expect too much—and too little—of others; he will expect too much and too little of himself. He will be bothered at every evidence of irrationality in himself; he will be troubled when he is unable to plan all his hours, days, and years and then carry out that plan to the last detail; he may wonder what is wrong with himself when he has not achieved the maximum efficiency which he thinks is reasonable. Further-

more, he may, in trying to regulate his life entirely by reason, sacrifice powers of activity and personal satisfaction which come from the rich emotional experience of which he is capable. The cost of these mistakes may be nagging frustrations which will sour personal relationships, convince him that engineering is not what it ought to be, and cause him to lose the confidence in himself which is basic to all human content.

Here the humanities and social studies should help the engineering student, although they will not necessarily solve all his problems. But certainly they should enable him to avoid some of the grosser errors. From literature and the arts, from history, anthropology, and sociology, he can discover how basic are some drives such as hunger, thirst, and sex, and how little subject to reason man is apt to become when satisfaction of these basic drives is threatened. He should learn that men need a sense of "belonging," of being important to a group; that they need to satisfy creative impulses; more than that, he should discover that these desires and the enjoyment which flows from their satisfaction are not purely rational, any more than are the feelings which result from the thwarting of those desires. Our students should learn from the humanities and social studies that men, in order to meet their many, many needs, put together techniques, great social institutions and myriads of material objects to create cultures, and that they weave through this whole structure ideas, ideals, and values which give meaning to their lives and to all they do during their lives. They should learn that men acquire strong attachments to ideals and institutions which have shaped their lives, and that they look at all problems through glasses colored by their training and by the faiths and moral values which have become the very foundations of their existence.

These are principles which engineering students can learn from the humanities and social studies. If they learn them, they can better understand themselves and other men; if they understand, they can better regulate their own lives in relationship to others, whether in home, church, club, politics, or professional activity.

Influence of Individual on Society

One of the major arguments used to support humanistic-social programs in engineering colleges has been the contention that engineers should be more active in the affairs of their communities. I shall not enter the argument as to whether engineers do as much as other professions do, largely because I feel that time thus spent gets us nowhere. Let us say that practically all of us need to do more, engineers included.

This is easy to say and hard to do. Difficulty arises, not from lack of opportunity. Engineers have many chances, many of which come in the regular line of duty. They could make many more if they were on the alert to do so.

The major obstacle to our taking a part in public affairs lies in one of the myths of American life, one we cherish fondly, perhaps because it provides an excuse for our inactivity. The myth is summed up in the statement, "What can I do about it? I am only one man."

If our engineering students are ever to take the part in public affairs which their abilities, their training, and the importance of their profession require, this myth must be killed. As long as a man feels that he can do nothing as an individual, he will attempt nothing.

Humanistic-social studies enter here. Nowhere else can we see so clearly the importance of the individual, especially in a society such as ours. A study of cultures, primitive or civilized, ancient or modern, will show inevitably the close tie-up of the individual and his culture, will prove that every idea, every technique, every proposal of a new form of social organization must occur first in the mind of some individual; that no great enterprise, started in the minds of individuals, can ever succeed unless it is supported by many individuals, working separately or in groups.

Study of the social sciences will indeed convince us that individuals are moulded in thought and action by the whole culture which surrounds them. But it will prove also that every individual cannot help but influence his culture. Complete neutrality in public matters is impossible except for the hermit, who has no public. Every individual influences the ideas and actions of every person with whom he associates; he cannot help it.

What the humanities and social studies can do, therefore, is to prove to our students that not only can they do something about it, they can not help doing something about it. The fact that each is only an individual is irrelevant; in all the history of man, no one has ever been anything more than an individual. Through that history most people have had little chance to exert great influence; in our culture they can. Therefore theirs is not a negligible opportunity or obligation. Before them lies a challenge such as few men in history have had.

To the extent that our students understand

this, they will become better engineers, performing their work because they realize its importance to man as well as because it brings a pay check. They will also become better, more active citizens, exercising their proper influence, contributing their considerable talents, and, incidentally, raising the status of their own profession.

Encouragement of Creative Potentialities

The humanities and social studies will fail in their job if they do not somehow help students to see and enjoy their own creative abilities and realize the opportunities for creative work in their profession.

Here is another area in which engineering training may prove a handicap. I have observed hundreds and hundreds of engineering students and have seen too many of them come to regard engineering as consisting of finding definite answers to clearly defined problems by a process of feeding data into equations and formulae. It is a mechanical and two-dimensional process which always comes up with the right answer.

I hasten to say that this is not my picture of engineering and it probably is not yours. I believe it *is* the picture held by far too many engineering students. Anything which can be done to change this conception will raise the standards of engineering education.

I hope you will agree that engineering education should stimulate rather than stifle creative impulses; that an engineering degree should not be a wreath placed on the student to mark the death of his imagination; that the engineering graduate should be a man who is not helpless when the routine methods of solving a problem have failed, who is sufficiently flexible and imaginative to put old things together in new ways and to go out and find new things so that he can do something which hasn't been done before. I hope you agree that an engineer should not lose his capacity to dream, or his ability to thrill from his own production of something new.

If these capacities are to be developed rather than suppressed in our students, we must tackle the job in different ways, just as we have to teach good methods of thinking in different situations. The humanities and social studies can and must contribute their share.

What can they give? An understanding of these facts: (1) that all peoples have exhibited an urge and ability to create; (2) that each engineering student has some such urge and ability, which he should encourage and enjoy; (3) that engineering, by its very nature, gives innumerable opportunities to its practitioners to create.

If the humanities and social studies show anything, it is that no people have lacked imagination and creative ability. Their powers have been expressed in various ways, through the development of new social institutions, through discovery and application of new techniques, through religion, literature, and the arts. Furthermore, every people has had an urge to create the beautiful. Creation is a human need.

So the engineering student, as a part of mankind, has need to create and to create the beautiful. Of this he should be aware, and of this he should not be ashamed. A humanistic-social program, before it has obtained its objectives, must make opportunities for the student to exercise his talents. These chances may take various forms: the finding of a better solution to a personal or social problem; the seeing of a new approach to a technical problem in all of its aspects, technical, social, personal, aesthetic; or the creation of a work of art. All of these and more might be means that the humanities and social studies could exploit to loosen the student's mind, to get him to use his imagination in conceiving a new idea and in carrying it out.

Do I hear a cry that this might undermine the "engineering method"? That it would seduce the student into trying too many harebrained schemes? I can only say that all great schemes have at some time seemed harebrained. And I do have faith that the engineering method "takes." I have no fears that if we encourage our students to use their imaginations, we shall suddenly have a rash of bridges suspended with raffia because that way the structures will look more rustic.

Finally, the humanities and social studies can show the engineering student the many opportunities to create in his profession. They can help him see that engineering is not merely a job, that it is a creative activity of great importance to the engineer and to the whole of society. He is constantly designing and building; he supervises the lay-out of work. Whatever he does, he establishes new situations which affect the lives of all men; he helps to turn loose upon the world a flood of material things which can add to or detract from the value of human life. He can help create greater joy or greater sorrow, more peace or more discord. He can create the ugly or the beautiful. This is one of his greatest opportunities.

ON IMPROVING THE TEACHING OF COLLEGE MATHEMATICS*

By

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The job of the college mathematics teacher is characterized by its variety. In the classroom he directs the learning activities of his students. Outside the classroom he selects the course objectives, organizes the teaching and study material, and selects textbooks, references, and problem material. He devises tests and other measuring instruments to determine the change that has taken place in the student as a result of taking the mathematics courses.

As a citizen and employee of the college, the college teacher, both as an individual and in cooperation with other faculty members, engages in other activities which affect the learning and growth of the students. For example, a problem may be posed by the fact that in a given school engineering students in their junior and senior engineering courses do not have an adequate command of the processes of algebra such as algebraic fractions, radicals and exponents, and the like. The attack on such a problem should be a cooperative one between the faculties of engineering and mathematics and may well call for persons from psychology and evaluation. Its solution will have definite effect on the departments involved as well as on the students.

Some mathematics teachers, of course, are hired by the university to devote all or part time to research. Creative research activity may take many forms in addition to pure and applied research: analysis, synthesis, and interpretation of research done by others; study of the purposes of college education in general and mathematical education in particular; creation and use of instructional materials including visual aids; or reorganization of subject matter to accomplish special ends for the needs of special groups of students. Such activity will go far toward keeping alive the teacher's interest and facility in creative work, enhance the quality of his instruction, excite in his students an interest in scholarship, and add to the sum total of human knowledge and understanding.

Briefly, the college teacher of mathematics must have a broad and well-rounded education, must understand young people and know how to direct their learning activities, must be able to select, organize, and present the subject matter of mathematics in such a way that needs of special groups will be met, must be able to discover whether or not his efforts have resulted in the desired changes in his students, and finally must be able and willing to engage in creative activity which will keep him alive, interested, and inspired for his profession as a college teacher.

TRAINING A COLLEGE MATHEMATICS TEACHER

How shall we train a person to carry on this complex job which has been sketched above?

It may be worth while, first of all, to consider some of the weaknesses of college teaching which have been pointed out by people interested in this problem. Such weaknesses have been summarized by Kelly under four large categories: (1) personal traits, (2) narrowness of training, (3) interest centered in research and not in teaching, and (4) lack of specific training for teaching.[1]

These weaknesses may be recognized as existing in varying degrees on all college campuses. Five suggestions for correction have been made: (1) Select graduate students on the basis of their talents and aptitudes for college teaching. (2) Provide better personal adjustment and personality development of prospective college teachers. (3) Adopt a graduate curriculum dictated by the needs of prospective college teachers. (4) Give 'teaching' academic respectability comparable with that of research on the university campus. (5) Educate prospective teachers in the science and art of teaching[2]. These suggestions were gleaned from responses sent in early in 1948 by 363 collegiate institutions to the University of Chicago's Committee on the Preparation of Teachers.

The weaknesses and suggestions listed above imply or state specifically certain kinds of training which the college teacher should have. The making of a good teacher of college mathematics includes selection or recruitment, of course, since

* Based on a paper read in Oklahoma City on October 12, 1951, before the Oklahoma Section of The Mathematical Association of America.

1 See Fred J. Kelly, *Toward Better College Teaching*, Federal Security Agency, Office of Education, Bulletin 1950, No. 13, Government Printing Office, Washington 25, D.C., pp. 5-7.

2 Fred J. Kelly, *ibid.*, pp. 7-12.

we must have good material to work on, but once a good prospective teacher of college mathematics is selected, his academic and professional training must be carefully planned and carried out. This training, which will include the undergraduate and graduate period, may be listed under three headings: general education, mathematical education, and professional education.

His General Education

The prospective teacher's training in general education should include a basic knowledge of the fundamental fields which affect our lives in our civilization and culture. These main fields are usually classified and taught in American colleges as the *humanities,* including literature, language and the arts, *social sciences,* including history, political science, sociology, psychology, and the like, the *biological sciences,* including botany, zoology, physiology, and the like, and the *physical sciences,* including physics, geology, chemistry, mathematics, and astronomy.

But general education is more than taking a sample of courses in such subjects as those listed above. Too often the courses are designed for the future specialist in chemistry, English, political science, and the like and make a poor offering for a student with some other goal. General education is often thought of as an attempt to get away from undue specialization in the fields outside the student's major and minor interest. That is, it is an attempt to correct the present emphasis on the acquisition of factual information and technical skills with primary emphasis on the intellectual development of the student. Positively the general education movement encourages integration of knowledge and the acquisition of a philosophy or point of view toward learning and toward life. Hence it is a matter of objectives and total effect of the educative process rather than subjects taught and devices used to get a desired effect.

If we think of general education as a set of conceptual structures designed to enable the student to cope with those life situations which are outside the mere vocational category, we see that a prescribed curriculum or a definite content may not do the job at all. In fact, it seems reasonable that more than one curriculum may accomplish the same end results. In any event it will be different and have different aims from specialistic education, and, since general education is one of the important functions of the modern college, as well as of the secondary school, it is imperative that the prospective college teacher obtain a good general education. He should also be exposed in some manner to the philosophy and purposes of general education at the college level.

His Mathematical Education

Since there is a wide interest in the improvement of college teaching[3], the subject matter training given to college teachers has received a considerable amount of criticism. The training of the teacher of college mathematics has been no exception to this general trend. Dr. Kelly's study, referred to above, summarizes well the good points or strengths of the college teacher as follows: (1) well prepared in his speciality, (2) competent as a research scholar, (3) generally high native intelligence, (4) generally and sincerely devoted to his scholarly interests. "It will be recognized at once that these are important strengths. They bear directly upon success in college teaching. But they do not alone assure success. While no one would want a college teacher who has not these strengths, an analysis of the weaknesses reported in the same replies indicates that these strengths may be largely ineffective if accompanied by certain weaknesses."[4]

Weaknesses listed include two which may be due partly to the type of subject matter training received by college teachers. They are: (1) training too narrow, (2) interest centered in research rather than teaching.

A training too narrow for the job which the college teacher must perform may be true within the field of mathematics. Teachers are often called upon to teach a wide range of subjects within the mathematics department. Intense specialization at the doctoral level may leave a man relatively unprepared and unwilling to deal with this wide range of elementary courses. This is more true, however, with respect to training in related subjects. The specialization programs and requirements of the graduate departments and schools leave too little time to obtain a broad training in related fields of learning. The professor in elementary courses particularly, must deal with students who may have a lively and often a dominant interest in some other field about which he, the professor, may know practically nothing.

The second weakness, interest centered in research rather than in teaching, is a vital problem

[3] See T. C. Blegen and R. M. Cooper: *The Preparation of College Teachers,* American Council on Education Studies, No. 42, Vol. XIV, July, 1950. Ralph W. McDonald, *Current Issues in Higher Education 1950,* Department of Higher Education, N.E.A., Washington, D. C., 1951. President's Commission on Higher Education: *Higher Education for American Democracy,* U.S. Government Printing Office, Washington, D.C., 1947.

[4] Fred J. Kelly, *Op. Cit.* p. 4.

to all who are interested in the improvement of college teaching. Such an attitude is often blamed solely on the type of training prevalent in the graduate schools. Where it exists, however, it is probably due to many causes. Too often the rewards to college teachers in prestige, promotion, salaries, etc., come to those who publish research papers rather than to those who are good teachers.

"It must be remembered always that weaknesses such as those listed [above] are not true of all Ph.D. graduates. Differences among graduate schools, among departments of a given graduate school, and among graduates of a given department in a school are both wide and widespread. But even more important is the fact that interest in teaching is natural to some people and no amount of emphasis on research in the graduate school will destroy it."[5]

Mathematicians and the mathematical societies of this country have been cognizant of these problems for a long time and have given repeated attention to them and to possible solutions. One such consideration resulted in a *Report on the Training of Teachers of Mathematics*[6] which gave consideration to the characteristics of the present doctoral training which is usually the desired prerequisite for permanent appointment as a professor of mathematics in the college and university. This report suggested the desirability of a second type of three-year training which provided for a breadth of training in mathematics as well as in related fields. The report did not call for less mathematics but for less specialized mathematics, and for other types of activity designed to give the young graduate student a breadth of training in his field and in related fields and also some specific training for the job he has to do.

The above discussion leads directly into the topic of Professional Education for college mathematics teachers.

His Professional Education

While there is a wide diversity of opinion as to how this specific training for teaching can be provided, "the large majority of the respondents (to the University of Chicago Study) believe that definite instruction in the art of teaching ought to be given as a part of the graduate program of the prospective college teacher."[7] It should be emphasized at this point that of the 106 institutions which responded to the University of Chicago Study, only ten were teachers colleges. The suggestions made by these college administrators and department heads were not always clear, but they were classified by Kelly into the following four categories: (1) instruction concerning the nature, purpose, and administrative organization of higher education, (2) psychology of college-age youth and preparation for counseling, (3) educational psychology, problems of learning, teaching, defining objectives, and using educational measurements, (4) apprentice teaching.[8]

As stated above these suggestions were made by college officials who are responsible for the selection of college teachers, and to quote Kelly's final statement: "They are asking the graduate schools to utilize courses dealing with college teaching and, either separately or in conjunction with these courses, to provide carefully supervised apprentice teaching. They are not suggesting that the graduate school turn the job over to the departments or schools of education. . . but whether they make use of the members of the education department or work up instruction materials of their own, the suggestions, mounting to a sort of chorus, indicate that the graduate departments should see that such instruction is made a part of the preparation of college teachers. . . The suggestion is frequently made, too, that the apprentice teaching should be parallel to or preceded by some basic instruction (seminar work perhaps) in the problems of teaching."[9]

The report of the Mathematical Association of America referred to earlier in this paper discussed the problem of the preparation of college mathematics teachers. It recommended that some departments of mathematics should offer a second type of three-year graduate training in addition to the present typical training for the doctorate. It suggested two varieties of three-year training as a basis for further discussion. Type I involved the preparation of a research thesis of the current variety. Type II might omit the customary kind of research thesis but include various substitute features. Both types of training would involve specialized preparation for teaching mathematics. Gradations between these two types might be used for adaptations to individual students.

The report recommended: an undergraduate major or field of concentration in mathematics; introductory courses in physics, astronomy, psychology, economics, one other science, and one

[5] Fred J. Kelly, *Op. Cit.* p. 6.
[6] *American Mathematical Monthly*, Vol. XLIII (1935) pp. 363-277.
[7] Fred J. Kelly, *Op. Cit.* pp. 11-13.
[8] Fred J. Kelly, *Op. Cit.* pp. 11-12.
[9] Fred J. Kelly, *Op. Cit.* pp. 11-13.

other social science; sufficient additional preparation in one field related to mathematics to meet the prerequisites for elementary graduate work in that field; training in English composition beyond the minimum required for a bachelor's degree; sufficient study of German and French to serve as a basis for learning to read mathematics in these languages.

It recommended graduate training for both Types I and II as follows: (1) foundation courses in each major subdivision of advanced mathematics, (2) elementary graduate work in at least one outside field related to mathematics, (3) specialized preparation for teaching mathematics, (4) a final examination, perhaps both oral and written.

For "Type I" the report recommended: (1) intensive specialization beyond the foundation material in some large field of mathematics as the basis for later research, (2) a research thesis of a caliber suitable for publication, where the topic and a minimum of general assistance may be given by a thesis director, but where the responsibility for the development of the topic rests strictly with the candidate.

For "Type II" it recommended: (1) additional course work in mathematics and in allied fields, with emphasis on breadth of training, (2) one or more expository papers of the variety known as *minor theses* in the existing requirements for the doctorate in mathematics in some universities. The candidate should give evidence of his ability to learn independently.[10]

It will be noted that for both types of training specialized preparation for teaching mathematics was recommended. This preparation, as specified in the report, should include; first, the equivalent of one year of observation and assisting three times a week in various college mathematics courses which are being taught by experienced members of the mathematics department; second, apprentice teaching in college mathematics under the observation of, and with later criticism by, faculty members of the department; and (3) guided reading in books and periodicals relating to teaching theory, testing, and educational research. The reading might be directed by a member of the mathematics department or an outside person who appreciates the viewpoint of teachers of mathematics. The report specified that typical courses in educational theory would not be a satisfactory substitute for the guided reading. Such reading "should prepare the candidate to evaluate intelligently or criticize constructively conclusions and methods with which he may later be confronted in the teaching profession."

The apprentice teaching, it was suggested, might advisedly be done in different courses and should involve participation in constructing and grading examinations. It should amount to at least two semester hours. The report questions the practice of employing graduate students who are relatively inexperienced in teaching as instructors in elementary mathematics courses. Such practice, it is stated, frequently has ill effects on the mathematical futures of the elementary students who are taught and is not a suitable substitute for apprentice teaching on the plan suggested.

These are definite suggestions regarding the improvement of collegiate mathematics teaching by making provisions for professional training at this level. Such suggestions have received some recognition in the graduate schools of this country, but it cannot be said that they have received widespread recognition.

This discussion on the improvement of the teaching of college mathematics is designed to raise certain questions rather than to state definite answers and solutions. A considerable and growing amount of source material and discussion which may be helpful in a further discussion of these problems exists and should be consulted by all who are interested in better teaching of college mathematics. The final answers, if indeed there be any final answers to a varied and changing problem such as this one, must be worked out by the professors in the departments and in the graduate schools. It is this group who must meet the problem of improving the teaching of college mathematics where the prospective teacher is being trained and where the beginner starts his work.

10 *American Mathematical Monthly*, Vol. XLIII (1935) pp. 266-268.

Loss and Peril

"The Master said, 'Learning without thought is labor lost; thought without learning is perilous.'"— The Analects of CONFUCIUS.

QUESTIONS CONCERNING DEMOCRATIC COLLEGE TEACHING

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The purposes of this article, motivated by an Heller's in the May issue of this publication,[1] are (1) to set forth a concept of democratic llege teaching and (2) to point out different isting approaches and apparent inconsistencies thin a given approach. Sources in the sparse erature of undergraduate methodology are few; ide from Dean Heller's article only two are ted here, one by Marie Rasey,[2] the other by athaniel Cantor,[3] books which present two different, concerted efforts to describe effective aching in more or less actual classroom situaons.

Two major questions emerge at the outset: 1) How much freedom of choice should be alted students in approaching the material of the urse? (2) What kind of direction, or leaderip, should be exercised by the teacher?

The first issue, regarding student freedom, nnot be divorced from the second, leadership rovided by the teacher. The basic principle that oth must work together, accepting each others' ifferences, is underscored by many writers on llege teaching. Yet it is not infrequent for these me persons to violate their positions by holding hat assigned readings are in order, along with xaminations, and that the teacher should be the tter of problems and the judge as to the adeuacy of their solution. Cantor, for example, requires weekly papers whose topics, in line with asic chapters in the text, are assigned at the eginning of the course.[4] Heller, unlike Cantor, alls for frequent tests, but he indicates that the eacher must know when to give students 'the rush-off.'[5] In short, is it possible to be 'democratic,' encouraging the recognition of individual ifferences and human dignity in classroom discussions while imposing external, set tasks outside f class and at certain times in class? Is self-reliance developed by being allowed to think hrough one's academic problems in one's own way in class on Monday morning and being told he must turn in teacher-assigned readings at nine a.m. sharp on Wednesday? No! Nor will such a practice as grading on the 'normal' curve make the student a well-adjusted, objective, unbiased, active participant in class discussion. On the contrary, he is likely to become accomplished at 'impressing' the teacher, in an endeavor to 'spoof' someone he believes is cheating him.

The question of the degree of choice to be granted students in approaching the subject matter in a responsible manner is, of course, a knotty one, for individual readiness, difficult to determine, is the starting point. Indeed, there may be instances where the class must begin under fairly authoritarian rule in order to provide the security to which they have become accustomed. But immediately, to become increasingly self-reliant, the students must be given as much freedom of choice as they can assume, freedom concerning how to approach the subject matter, how to be evaluated, and, within reason, what material should be studied within the confines of the course.

The real approach to the problem of promoting effective teaching lies (1) in the way the teacher views how students learn and (2) how he believes he can help them. One might think that there would be no conflict between these two factors, and yet there is. For example, Cantor[6] and Rasey[7] who both see reacting and doing, or reconstructing, as the essential process involved in learning, differ radically as to how the teacher should operate in class. Cantor plays backstop, directing but remaining aloof from the discussion, refusing to lend sympathy to individual difficulties, inside or outside of class, because he believes that compassion draws willingness *out* of the student.[8] Rasey, on the other hand, constantly remains part of the group, *drawing out* the student, herself accepting the role of active learner. In actual in-class operation, then, one sees Cantor as a backstop, heckler, and traffic cop; Rasey, as an active learner and member of the group.[9]

Continued on next page

1 Hobart F. Heller, "What is Good College Teaching?" *Improving College and University Teaching*, Vol. I, No. 2, May 1953, pp. 16-18.
2 Marie I. Rasey, *This is Teaching*. New York: Harper and Brothers, 1950.
3 Nathaniel Cantor, *The Dynamics of Learning*. Buffalo, N. Y. 1946.
4 *Ibid.*, p. 166.
5 *Op. cit.*, p. 17.
6 *Op. cit.*
7 *Op. cit.*
8 *Op. cit.*, pp. 171-173.
9 One does not, unfortunately, have much evidence of the nature of Rasey's out-of-class conferences, but if her approach is consistent with that employed in class, she is not only sympathetic but helpful in providing further ways of looking at problems, in supplying additional references the student has been unable to locate, and so on. Cantor, indeed, follows his own in-class practice outside, always coldly throwing students' problems back, not *to*, but *at* them.

These Books Were Stimulating

Books being read during the current year by members of a faculty-student seminar in college and university teaching are briefly annotated in most cases by excerpts from students' reading reports.

American Accounting Association Editorial Committee. **Accounting Teachers' Guide.** Pp. xiii+258. Chicago: South-Western Publishing Co. 1953.
Most topics are of concern for any college teacher regardless of subject field: "a more effective teacher, teaching aids, testing, teacher's self-audit, student evaluation of teacher."

Fuess, Claude M., and Emory S. Basford. **Unseen Harvests.** Pp. xx+678. New York: The Macmillan Company. 1947.
"Hazards, annoyances, and durable satisfactions of the profession. May be picked up at random by professors."

Havemann, Ernest, and Patricia Salter West. **They Went to College:** The College Graduate in America Today. Pp. x+277. New York: Harcourt, Brace and Company. 1952.
"For teachers who are interested in students, this is good reading."

Heaton, Kenneth L. **The Character Emphasis in Education.** Pp. ix+415. Chicago: University of Chicago Press. 1941.
"Though concerned with levels of education below college, this book is worth knowing by university teacher. Example: methods that help build character, methods that are destructive."

Kelley, Earl C. **Education for What is Real.** Foreword by John Dewey. Pp. xiv+114. New York: Harper & Brothers. 1947.
Said Dewey: "A work whose significance will prove virtually inexhaustible."

National Society of College Teachers of Education. **Quantitative Measurements in Institutions of Higher Learning.** Pp. ix+253. Chicago: University of Chicago Press. 1930.
"Of most interest was the chapter on use of quantitative measurement in the evaluation of teaching."

Ogan, R. W., et al. **A College Looks at Its Program.** Pp. x+326. New Concord, Ohio: Muskingum College. 1937.
"A thorough study of the program of a college with the frank idea of how well it was attaining its ends."

Payne, Stanley L. **The Art of Askin**
Foreword by Hadley Cantril. Pp. xiv-
ton, N. J.: Princeton University Press.
"Perhaps students should be the ones who ask the qu
but if teachers are going to do it they can certainly
some suggestions here."

Phelps, William Lyon. **The Excitement of Teachi**
Pp. 80. New York: Horace Liveright. 1931.
"Very interesting reading though dated as to content."

Rasey, Marie I. **It Takes Time.** Foreword by Ka
Horney, M.D. Pp. x+204. New York: Har
& Brothers. 1953.
"An autobiography of the teaching profession." "Ser
able not only to teachers in process of becoming, but
to each of us whose preference falls on the side of lea
his life rather than being led by it."

Spence, Ralph B. **The Improvement of College Ma**
ing Systems. Pp. vi+89. New York: Bureau
Publication, Teachers College, Columbia Univ
sity. 1927.
"Review of marking systems and a suggested plan
improvement."

Struck, F. Theodore, **Creative Teaching.** Pp. xxv+
New York: John Wiley & Sons, Inc. 1938.
For teachers "striving toward goals not yet realized
toward standards not yet attained." Concerned prim
with secondary level and industrial arts subject ma
College teachers who can "translate" into their own
may find here a library of ideas.

Simpson, Ray H., and E. S. Brown. **College Learn**
and Teaching. Pp. 80. Urbana, Ill.: University
Illinois Bulletin, Volume 49, Number 75, June 1
The problem of effective college teaching and learning,
mary of learnings being practiced in college and unive
classes, improving college teaching.

Tead, Ordway. **Trustees, Teachers, Students:**
Role in Higher Education. Pp. 120. Salt L
City: University of Utah Press. 1951.
"Tead shoots down the smug, the complacent, and say
colleges must have and foster a 'creative discontent.'"

Tead, Ordway. **Character Building and Higher E**
cation. Pp. x+129. New York: The Macmi
Company. 1953.
"Overtones and subtleties in 'straight thinking' beyond
brilliant exposition in that process set forth in Dew
classic, *How We Think.*"

Democratic College Teaching—*Continued from p. 19.*

What sort of counseling, or directive relationship, then, provides for the most successful general education teaching? One hears of the practice of absolute nondirective counseling, where the teacher relinquishes all control and sits by while the class runs itself, studying what it wants to, in relation to the confines of the course, using its own and other resources, evaluating itself as, and if, it will, a method highly akin to the group dynamics, workshop approach. One hears also of friendly, warm relationships where, as in Rasey's technique, the teacher sometimes acts as chairman, at others as a class member, and often in combination. And, as has just been noted, there is the stony backstop manner of operating, as e ployed by Professor Cantor.

Is it possible for a teacher to be helpful wi out coddling Molly, sympathetic with and so what directive toward those who, really appl themselves, need a particular kind of help, humanely nondirective to those who are fa to face their own inadequacies? Or is such a of view, expressed by Dean Heller as uti the sixth sense in realizing what approa employ,[10] inconsistent? And if so, to mis slightly one-time teacher Emerson, could that "a foolish consistency is the hobgo little minds and little men?"

10 *Op. cit.*, p. 17.

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M May issue
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